

U.S. PATENT & TRADEMARK OFFICE

APPLICATION FOR UNITED STATES LETTERS PATENT

Title: **AUTOMATED BANKING
MACHINE**
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CROSS REFERENCE TO RELATED APPLICATIONS

This Application is a Continuation-In-Part of Serial No. 09/911,329 filed July 23, 2001 which is a Continuation-in-Part of Serial No. 08/980,467 filed November 28, 1997 now Patent No. 6,273,413; and is also a Continuation-in-Part of Serial No. 09/390,929 filed September 7, 1999 which claims benefit of provisional application 60/100,758 filed September 7, 1998; and is also a Continuation-in-Part of Serial No. 09/664,698 filed September 19, 2000 which claims benefit of Provisional Application 60/155,281 filed September 21, 1999; and also claims benefit of Provisional Application filed on November 5, 2001 as Express Mail Label No. EL918747929US; the disclosures of all of the foregoing being incorporated by reference as if fully rewritten herein.

TECHNICAL FIELD

This invention relates to automated banking machines. Specifically, this invention relates to an automated banking machine which delivers and receives various types of sheet materials through a single opening in the machine.

BACKGROUND ART

Automated banking machines are known in the prior art. A common type of automated banking machine is an automated teller machine (ATM). ATMs may be used by individuals to receive cash from their accounts, to pay bills, to transfer cash between accounts, and to make deposits. Certain ATMs also enable customers to deposit checks, money orders, travelers checks, or other instruments. Such ATMs sometimes have the capability of creating an electronic image of a deposited instrument.

ATMs may also provide various types of sheets to customers. Such sheets include currency bills that customers withdraw from the machine. Customers may also receive sheet materials such as money orders, bank checks, scrip, stamps or other sheet materials stored in or produced by the machine. Customers may also receive from an ATM a printed sheet which is a receipt indicating the particulars of the transactions they have conducted at the machine. In addition customers may request and receive from some ATMs a more detailed statement of transactions conducted on their account.

ATMs currently in use often have several different locations on the machine where sheets are received from or delivered to a customer. For example, most machines include one area for delivering cash to a customer and another area for receiving deposits. More than one deposit receiving area may also be provided for different types of deposits. For example, an ATM may have one opening for receiving envelope deposits, and a separate opening for receiving negotiable instruments, such as checks. ATMs may also have a particular area for delivering receipts to the customer. If the machine has the capability of printing a complete account statement on larger paper an additional area may be provided where statement sheets are delivered.

Having different areas on the customer interface of an ATM to receive and provide different types of sheets is required because each type of sheet is processed by a different mechanism within the machine. Each of these mechanisms has its own separate access to the customer. This makes machines with different features substantially different from other machines and adds complexity to their operation. Providing several different passageways and

transports for receiving and providing sheet materials to customers also adds complexity and cost to a machine.

While the drawbacks associated with multiple sheet delivery and receiving openings is easily appreciated with regard to ATMs, other automated banking machines have similar drawbacks. For example the machines used by bank tellers to count currency received from customers are generally totally different machines than those used to dispense currency that is to be provided by the teller to a customer. Separate machines are also provided for receiving and imaging checks and other types of negotiable instruments and documents of value. Often a separate terminal is provided to print a record of a transaction for a customer. The drawbacks associated with having different machine interfaces to receive and deliver documents is common to automated banking machines other than ATMs. Thus there exists a need for an automated banking machine that has a simpler user interface, which is capable of receiving as well as providing various types of sheets through a single opening, and which may be capable of carrying out a variety of transactions.

DISCLOSURE OF INVENTION

It is an object of an exemplary embodiment of the present invention to provide an automated banking machine.

It is a further object of an exemplary embodiment of the present invention to provide an automated banking machine which has a simpler customer interface.

It is a further object of an exemplary embodiment of the present invention to provide an automated banking machine which has a single opening for receiving and providing various types of sheets and documents.

It is a further object of an exemplary embodiment of the present invention to provide an automated banking machine which performs a plurality of banking transaction functions and which has a compact physical size.

It is a further object of an exemplary embodiment of the present invention to provide an automated banking machine that may be more readily configured to provide different banking functions.

It is a further object of an exemplary embodiment of the present invention to provide an automated banking machine that is economical to manufacture and operate.

It is a further object of an exemplary embodiment of the present invention to provide an automated banking machine that accepts and delivers various types of banking documents in a stack from and to customers, respectively.

It is a further object of an exemplary embodiment of the present invention to provide an automated banking machine that enables selectively separating sheets from a stack and processing such sheets in different ways depending upon the type of sheet.

It is a further object of an exemplary embodiment of the present invention to provide an automated banking machine that enables selectively assembling document sheets into a stack.

It is a further object of an exemplary embodiment of the present invention to provide a method for operation of an automated banking machine in which sheets are selectively removed from a stack by transporting the stack in a first transport path through an intersection with a

second transport path, in which a sheet directing apparatus adjacent to the intersection selectively separates sheets from the stack.

It is a further object of an exemplary embodiment of the present invention to provide a method for operation of an automated banking machine in which a sheet moving in a first transport path and a sheet moving in a second transport path are brought together in aligned relation to form a stack, as the sheets pass through an intersection of the first and second transport paths.

Further objects of exemplary embodiments of the present invention will remain apparent in the following Best Modes for Carrying Out Invention and the appended claims.

The foregoing objects are accomplished in an exemplary embodiment of the present invention by an automated banking machine having a transport which moves sheets or stacks of sheets along a first transport path. The first transport path extends from a user accessible opening on an interface of the machine. The machine also includes an internal second transport path for transporting sheets. The second transport path meets the first transport path at an intersection. A sheet directing apparatus is positioned adjacent to the intersection. The machine further includes at least one sheet dispensing device and at least one sheet accepting device for dispensing and receiving sheets, respectively. The sheet dispensing and receiving devices are in operative connection with either the first or second transport paths.

In operation of the machine a stack of sheets which may include various types of documents is received from a user is moved from the opening along the first transport path. As the stack passes the intersection the sheet directing apparatus is selectively operative to separate a sheet from the stack and direct the sheet into the second transport path. Once in the second

transport path the separated sheet may be handled individually for processing or storage in the machine. Passing the stack through the intersection enables selectively removing sheets from the stack in response to operation of the sheet directing apparatus.

5 Sheets dispensed or otherwise held in the machine are enabled to be assembled into a stack by moving a sheet in the first transport path. A sheet in the second transport path is moved to the intersection in coordinated relation with the first sheet. The first and second sheets engage in aligned relation and form a stack in the first transport path as the sheets move through the intersection. Additional sheets are selectively added to the stack as the stack is thereafter again moved through the intersection while successive sheets are brought to the intersection through the second transport path. Various types of sheets are selectively assembled into the stack in the operation of the machine. Control circuitry operates the components of the machine to assemble the stack. Once the stack is assembled, it is delivered to the user by passing it along the first transport path to the user opening.

15 In exemplary embodiments data may be acquired and stored which is usable to determine the individual users who have provided and/or received particular sheets from the machine. This may enable the machine to determine the source or disposition of suspect notes for example. Alternatively or in addition, exemplary embodiments may limit the dispense of documents such as checks, money orders or cash from the machine to particular individuals to reduce the risk of money laundering or other illegal or fraudulent activity. Other exemplary embodiments may
20 include other or additional features.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a front plan view of an exemplary automated banking machine including some features of the present invention.

Figure 2 is a left side view of the automated banking machine shown in Figure 1.

Figure 3 is a schematic cross sectional view of the automated banking machine shown in Figure 1.

Figure 4 is a side schematic view of a first transport path and a second transport path in the automated banking machine.

Figure 5 is a transverse cross sectional view of a transport used in the automated banking machine.

Figure 6 is a schematic side view of a sheet moving from the second transport path to the first transport path through an intersection.

Figure 7 is a view similar to Figure 6 with the sheet moved into the first transport path from the intersection.

Figure 8 is a schematic view similar to Figure 7 with the sheet moving in an opposed direction through the intersection.

Figure 9 is a schematic view similar to Figure 8 with the sheet held in a holding device.

Figure 10 is a view similar to Figure 9 with the sheet moving in the intersection and engaging a second sheet being delivered through the second transport path, the second sheet engaging in aligned relation with the first sheet to form a stack.

Figure 11 is a schematic view similar to Figure 10 in which the stacked pair of sheets have passed through the intersection.

Figure 12 is a schematic view similar to Figure 11 in which the stacked sheets are held in the holding device.

Figure 13 is a schematic view of the first and second transport paths with the sheet directing apparatus operating to separate a first sheet from a stack as the stack passes through the intersection.

Figure 14 is a schematic view similar to Figure 13 showing the sheet separating from the stack as the stack passes through the intersection.

Figure 15 is a schematic view of the first and second transport paths showing a sheet being reoriented by a sheet turnover device.

Figure 16 is a schematic view showing a sheet passing through a second intersection between the first transport path and a third transport path.

Figure 17 is a schematic view of the first and second transport paths with a deposit envelope passing therethrough.

Figure 18 is a schematic view showing the first, second and third transport paths, with a sheet moving from the holding device to the third transport path.

Figure 19 is a schematic view of an alternative embodiment of the first, second and third transport paths with additional holding devices in the first transport path.

Figure 20 is a schematic view showing the first and second transport paths with a sheet moving from the second transport path to the first transport path, and schematically demonstrating how the sheet directing apparatus is used as part of a sheet turnover device.

Figure 21 is a schematic view of an alternative embodiment of the first, second and third transport paths used in an alternative automated banking machine in which two user interfaces and user accessible openings are provided.

Figure 22 is a side view of an automated banking machine housing the transport apparatus schematically shown in Figure 21.

Figure 23 is a schematic view showing a sheet separating from or adding to a stack as the stack passes through an intersection.

BEST MODES FOR CARRYING OUT INVENTION

Referring now to the drawings, and particularly to Figure 1, there is shown therein an automated banking machine generally indicated 10. Machine 10 is an ATM. However, other embodiments of the invention may be other types of automated banking machines. ATM 10 includes a user or customer interface generally indicated 12. Customer interface 12 includes a touch screen 14. Touch screen 14 is of a type known in the prior art which serves as both an input device and an output device. The touch screen enables outputs through displays on the screen and enables customers to provide inputs by placing a finger adjacent to areas of the screen.

Customer interface 12 further includes a keypad 16. Keypad 16 includes a plurality of buttons which may be actuated by a customer to provide inputs to the machine. Customer interface 12 further includes a card reader slot 18. Card slot 18 is used to input a card with encoded data thereon that is usable to identify the customer and/or the customer's account information. Card slot 18 is connected to a card reader of a conventional type for reading data encoded on the card. Other exemplary embodiments may include types of input devices other

than a card reader and/or a keypad. Some embodiments may include input devices such as biometric readers that may be operative to receive customer identifying inputs such as fingerprints, iris scans, retina scans, face topography data, voice data or other inputs that provide data that is usable to identify a user. An example of an ATM that uses biometric input devices and other types of input devices is shown in U.S. Patent No. 6,023,688 the disclosure of which is incorporated herein by reference.

Customer interface 12 further includes an opening 20. Opening 20 as later explained, is used to receive stacks of sheets or documents from a customer operating machine 10. Opening 20 is also used to deliver stacks of documents to customers operating the machine. Although opening 20 is shown exposed in Figure 1, it should be understood that in other embodiments it may be selectively covered by a movable gate or similar closure structure. It should be understood that these features of the described ATM user interface are exemplary and in other embodiments the user interface may include different components and/or features.

As shown in Figure 2 machine 10 has a generally divided body structure which includes a chest portion 22. Chest portion 22 in the exemplary embodiment is preferably a secure chest and is used for holding items of value such as currency or deposits. Chest portion 22 has a door 24 which can be selectively opened to gain access to the interior of the chest portion. Door 24 preferably includes a combination lock or other locking mechanism (not shown) which prevents the chest portion from being opened by unauthorized persons.

Machine 10 further includes an upper enclosure portion 26. The upper enclosure portion has components of the customer interface 12 thereon. The customer interface portion 12 includes a fascia 28. Fascia 28 is preferably movably mounted on the upper enclosure portion 26 and may

be selectively opened to gain access to components housed in the upper enclosure portion. A locking mechanism (not shown) is preferably included in the upper enclosure portion of the exemplary embodiment for preventing unauthorized persons from gaining access to the interior thereof.

5 As shown in Figure 3 machine 10 includes a plurality of devices for carrying out banking transactions. It should be understood that the devices discussed hereafter are exemplary and that additional or different devices may be included in other embodiments of the invention.

10 The interior of ATM 10 is schematically shown in Figure 3. The exemplary ATM includes devices for handling sheets such as notes and other documents. ATM 10 includes sheet dispensing devices, document producing devices and sheet receiving devices. Among the sheet dispensing devices are currency dispensers 30 and 32. Currency dispensers 30 and 32 may be of the type shown in U.S. Patent No. 4,494,747, the disclosure of which is incorporated herein, which selectively dispense sheets one at a time in response to control signals. Currency dispensers 30 and 32 may include removable sheet holding containers or canisters which include
15 indicia thereon. The canisters may be interchangeable and of the type shown in U.S. Patent No. 4,871,085, the disclosure of which is incorporated herein. The indicia on the sheet holding canisters may be indicative of the type and/or properties of sheets held therein (i.e. currency type and denomination) and the indicia is read by a reading apparatus when the canister is installed in the machine.

20 The exemplary ATM may operate in response to the indicia on the canisters to adjust the operation of the dispensers to conform to the canister contents and position. In the exemplary embodiment the sheet holding canisters and other devices, may include indicia of the type shown

in U.S. Patent 4,871,085. The information represented by the indicia is read by the reading apparatus and the resulting signals transmitted to the machine control circuitry. The control circuitry adjusts operation of the sheet dispensing and receiving devices in response to the signals to conform to the type and character of the sheets held in the various canisters.

5 In the exemplary embodiment of machine 10 shown in Figure 3, the machine preferably includes a note handling mechanism including sheet receiving and delivering devices 34, 36 and 38. The exemplary sheet receiving and delivering devices may be of the type shown in U.S.

Application Serial No. 09/390,929 filed September 7, 1999, the disclosure of which is incorporated herein by reference. The sheet delivering and receiving devices may enable receiving and storing sheets in selected compartments as well as selectively delivering sheets from the various compartments. As can be appreciated from the incorporated disclosure, some of the note handling mechanisms may receive and store notes only, others may dispense notes only and some may both receive and dispense notes. Other mechanisms may process sheets of types other than notes. Machine 10 further includes an envelope depository schematically indicated

15 40. Depository 40 is a device configured to accept and hold relatively thick sheet-like deposit envelopes deposited by customers in the machine.

Depository 40, currency dispensers 30 and 32 and sheet receiving and delivering devices 34, 36 and 38 are all positioned within the chest portion 22 of the machine 10. In the exemplary embodiment, the sheet dispensing and receiving devices, except for the depository, in the
20 exemplary embodiment may be interchangeably positioned in the machine. The control circuitry adjusts operation of the machine accordingly based on the device positions and the indicia on the canisters or devices.

Each of the currency dispensers 30 and 32, sheet receiving and delivering devices 34, 36 and 38, and the depository 40 are in communication with a sheet transport path generally indicated 42. Sheet transport path 42 comprises a plurality of sheet transports which are aligned and in operative connection through a rear area of the chest portion. Sheet transport path 42 may include one or more sheet transports of the type shown in U.S. Patent 5,240,638, the disclosure of which is incorporated herein. Each of the depository 40, currency dispensers 30 and 32 and sheet receiving and delivering devices 34, 36 and 38 are in operative connection with the sheet transport path 42, and are enabled to deliver sheets to and/or receive sheets from the sheet transport path 42.

Sheet transport path 42 extends through an opening (not shown) in the chest portion 22 of the ATM chest. Wiring that connects components located in the chest portion with components in the upper enclosure portion 26 also extends through an opening in the chest portion and is connected to control circuitry, schematically indicated 44. The control circuitry 44 preferably includes at least one processor in operative connection with at least one memory or data store, and is operative to carry out programmed instructions based on data stored in the memory. The control circuitry in the exemplary embodiment operates the machine to carry out the operations hereinafter described.

Upper enclosure portion 26 includes the fascia 28 and the customer accessible opening 20. A first transport path generally indicated 46 extends inside the machine from opening 20. First transport path 46 preferably includes an interwoven belt type transport of the type shown in U.S. Patent 5,797,599, the disclosure of which is incorporated by reference. A transport of this type is schematically shown in Figure 5 and is generally indicated 48.

Transport 48 includes a plurality of spaced first rolls 50 and a plurality of intermediate spaced second rolls 52. Rolls 50 and 52, which are preferably crowned rolls, support elastomeric belts thereon. First rolls 50 support first belts 54 and second rolls 52 support second belts 56. Belts 54 and 56 extend longitudinally in the transport 48.

5 A stack of sheets schematically represented by sheet 58 in Figure 5, move in engaged relation with belts 54 and 56 in the transport as described in the incorporated patent disclosure. The configuration of transport 48 enables transporting stacks having varied numbers and types of sheets, as well as transporting passbooks and other forms of stacked sheets. The transport of the exemplary embodiment is useful because of its ability to transport sheets of various types, having varied thicknesses and frictional properties while minimizing skewing.

Referring again to Figure 3, first transport path 46 intersects with transport path 42 at a first intersection, generally indicated 60. As hereinafter explained the exemplary embodiment comprises a separating mechanism that separates sheets individually from a stack and a stack assembly mechanism that produces a stack of documents. In the exemplary embodiment, sheets
15 are selectively stacked and unstacked while moving through first intersection 60 to enable processing of sheets within the machine 10.

Upper enclosure portion 26 also includes various sheet producing, dispensing and/or receiving devices. These dispensing and receiving devices may include dispensers or devices for receiving or dispensing sheets similar to those shown in U.S. Patent 4,494,747 or U.S.

20 Application Serial No. 09/390,929, and may include removable canisters for holding sheets therein. Such removable canisters may also include indicia of the type described in U.S. Patent

4,871,085, which are read by apparatus within the machine. The control circuitry may be operative to control the operation of the machine in response to the indicia.

Devices 62 and 64 may serve as part of document producing device and may hold sheets such as blank receipt or statement forms. Alternatively, one of such canisters may hold blank instruments which must be completed, such as scrip forms, money orders or travelers checks. A further sheet dispensing device 66 may dispense documents that need to be completed before dispense documents that need to be completed before dispense such as bank checks or documents that are dispensed without further processing such as plates of stamps.

A sheet receiving device 68 is also preferably included in the upper enclosure portion. Sheet receiving device 68 may be used for holding sheets such as checks or other instruments, which have been input by a customer to the machine and which have been imaged and/or canceled through processing in the machine.

The exemplary upper enclosure portion further includes at least one printing device schematically indicated 70. Printing device 70 may be used for selectively printing on sheets under control of the control circuitry. An imaging device schematically indicated 72 is also included. Imaging device 72 is preferably of the type which enables reading and generating an electronic image of a document, such as that shown in U.S. Patent 5,534,682 or U.S. Patent No. 5,923,413 the disclosures of each of which are incorporated as if fully rewritten herein. In some embodiments an imaging device may operate in conjunction with the control circuitry to produce signals which comprise an electronic representation of an image of a check or other instrument. The electronic representation may include all or selected portions of one or both sides of the sheet. For example in some situations it may be suitable to obtain an electronic image of

alphabetic, numerical and/or other symbols or features on the check. For example such data may be analyzed using character recognition software such as software commercially available from Check Solutions Inc. or other companies to determine the maker, amount and/or other data pertinent to the check for purposes of receiving and/or cashing the check.

5 In some embodiments printing devices or other devices may also serve as part of a cancellation device. Such a cancellation device may serve to print or otherwise mark checks or other documents received by the machine. For example, the machine may mark as cancelled checks which are received and processed by the ATM. In some embodiments such checks or documents may be marked through operation of the cancellation device and then stored in a check storage location in the machine. In other embodiments the cancellation device after the document has been imaged, may mark the document as cancelled and return the cancelled document to the user of the machine. In some embodiments one or more such cancelled documents may be assembled in a stack in a manner hereafter discussed, when returned to a user. Cancelled documents may also be returned in an assembled stack with other documents such as a receipt for the transaction and/or notes dispensed by the ATM as a result of cashing the check. 15 The control circuitry may also operate to store data corresponding to the check and the identity of the user of the ATM providing the check to the machine in one or more data store for purposes of record keeping. For example the data store may store data corresponding to the check with the data that corresponds to a user's account number, biometric data, photograph or other data usable to identify a user. Of course these approaches are exemplary and other approaches may be used. 20

In some embodiments the control circuitry may operate to check the user identity data before cashing one or more checks. The control circuitry may also be programmed to limit the

risk of check cashing by unauthorized persons and/or to reduce the risk of money laundering. For example before cashing a check the control circuitry may operate to compare data corresponding to the characters identifying the payee indicated on the check to other input data corresponding to the user of the machine and/or to the characters on the check comprising the endorsement. If the payee, user and/or endorsement data does not correspond, the control circuitry may operate so that the check is not accepted or cashed. Further the control circuitry may operate to determine the amount and/or nature of checks the particular user has presented at the ATM and/or within a prior time period. The ATM may also operate to communicate with other computers in a network to determine the amount or nature of checks presented by the user at other ATMs. If the user's check presenting activities fall outside certain established programmed parameters, such that the user's activities may be indicative of theft of the check or money laundering, for example, the ATM may refuse the transaction.

In the alternative and/or in addition a user presenting a check may be required by the control circuitry to provide at least one biometric input. This may be done even in circumstances where the user may be identifiable by data on a card or another manner. The biometric identification data may be compared to stored data and used to evaluate the check cashing activities of this particular user. A determination may be made by the control circuitry or by a remote computer to determine if the activities fall outside the established parameters such that the current transaction is suspicious and not permitted. In this way a user with multiple cards and/or multiple identities may be prevented from conducting transactions that might be suspicious in terms of theft or money laundering. Of course some embodiments may also operate to cross check biometric data with data on a debit or credit card or other item or other device

presented by the user to the ATM to provide greater assurance as to the identity of the user. Of course in other embodiments other approaches may be used.

The exemplary handling devices 62, 64 and 66, as well as the sheet receiving device 68, of the ATM are all in communication with one or more transports. These transports may be of the type shown in U.S. Patent 5,342,165, the disclosure of which is incorporated herein, or other suitable sheet transport devices. The sheet transport devices form a sheet transport path 74. Sheet transport path 74 extends to transport path 46 and meets transport path 46 at a second intersection 76.

The upper enclosure portion may also include additional or other devices. Such devices may include a journal printer as schematically indicated by rolls 78. The journal printer is used to make a paper record of transactions conducted at machine 10. Electronic journals may also be made by the control circuitry and stored in memory. Other devices which may be included in the machine are other types of document producing devices, audio output devices, customer sensors, cameras and recorders, biometric sensing devices and other apparatus suitable for use in the operation of the particular type of automated banking machine.

Transport paths 42, 46 and 74 of the exemplary machine are shown in greater detail in Figure 4. Transport path 46, which includes one or more transports of the interwoven belt type shown in Figure 5. The transport path has therein a plurality of first belts 80 which extend between first rolls 82 and 84. First rolls 82 and 84 are selectively driven by a reversible drive, schematically indicated 86.

Second belts 88 extend between a second roll 90 and rolls 92, 94 and 96. Second belts 88 are driven by a second reversible drive schematically indicated 98. As shown in Figure 4, roll 96

is selectively movable for purposes which are later explained. Of course it should be understood that the belts and rolls shown in the first transport path 46 are actually a plurality of spaced belts and rolls of the type shown in Figure 5.

First transport path 46 further includes a further transport section 100. Transport section 100 is similar to the transport shown in Figure 5 and includes a plurality of third belts 102 journaled on spaced rolls 104 and 106.

Rolls 106 have positioned adjacent thereto a plurality of holding rolls 108. Rolls 108 are positioned in spaced axial intermediate relation of third belts 102. This configuration imparts a wave configuration to sheets and stacks of sheets in a manner comparable to that imparted to sheets held by transport 48 as shown in Figure 5. Holding rolls 108 and transport section 100 are independently driven by reversible drives (not shown) under the control of the control circuitry 44.

Adjacent to first intersection 60, where sheet path 42 meets sheet path 46, is a sheet directing apparatus generally indicated 110. Sheet directing apparatus 110 includes sheet engaging rolls 112 and further rolls 114. Rolls 112 and 114 have resilient belts 116 mounted thereon. It should be understood that rolls 112 and 114 are driven by one or more independent reversible drives (not shown) under control of the control circuitry 44. It should be understood that rolls 112 and 114 and belts 116 in Figure 4, represent a plurality of such belts and rolls which are preferably disposed in intermediate relation between the lower flights of first belts 80.

Transport path 42 further includes transport 118 which is adjacent to depository 40. Transport 118 includes a plurality of rolls which drive belts 120 in response to a reversing drive (not shown). Rolls 122 which are engaged with belts 120, as well as rolls 124 which are

independently driven by one or more reversible drives (not shown), are positioned in the sheet path 42 adjacent to rolls 114 and 96. The purpose of this configuration is later discussed in detail.

As schematically represented in Figure 4 transport path 46 includes sensing devices.

5 These sensing devices are in operative connection with the control circuitry 44, and operate to sense features of sheets and stacks of sheets in the sheet transport path. A thickness sensor schematically indicated 126 is preferably provided for sensing the thickness of sheets, stacks of sheets, or sheet like deposit envelopes that move along transport path 46. Indicia reading devices 128 and 130 are preferably operative to sense indicia on sheets and envelopes moving in the transport path. The sensing devices may include photo reflective devices, magnetic sensing devices or other appropriate devices for distinguishing currency, various types of negotiable instruments and deposit envelopes. For example in some embodiments the sensing devices in combination with the control circuitry in the machine may comprise a validating device for assessing the validity of notes or other documents. An example of such a validating device is
15 shown in U.S. Patent 5,923,413 the disclosure of which is incorporated herein. In some embodiments the validating device may additionally or alternatively be operative to identify individual notes. For example, the validating device may produce through algorithms one or more distinctive values that are generally uniquely associated with a particular note. In addition or in the alternative, the validating device may include character recognition capabilities which
20 enable determination of the serial numbers or other unique characters associated with particular notes. This may enable some embodiments of the machine to store in correlated relation in at least one data store, data that uniquely identifies a note input to the ATM and the particular user

who provided the note to the machine. This may enable the ATM to identify a particular suspect note and capture the information on the user who provided it to the machine. The particular type, position and capabilities of sensing devices and/or validating devices used in a particular machine will depend on the characteristics and types of documents which are intended to be processed by the machine.

Various sheet manipulating and processing operations performed by the exemplary automated banking machine of the described embodiment are now explained in detail with reference to Figures 6-21.

Figure 6 shows a sheet 132 moving through the intersection 60 of the first sheet path 46 and sheet path 42. Sheet 132, prior to reaching the position shown in Figure 6, may have been dispensed by one of the sheet dispensing devices positioned adjacent to transport path 42 and moved adjacent to the intersection by the transports which make up the transport path. As sheet 132 approaches the intersection it is engaged by belts 116 of the sheet directing apparatus 110, as well as belts 88. The control circuitry operates the drives which move the belts to work in cooperating relation to move the sheet toward the intersection. Once the sheet is passed through the intersection it is engaged between the lower flights of belt 80 and the upper flights of belts 88, and the sheet 132 is carried in the first direction indicated by Arrow A in Figure 6. As will be appreciated from Figure 4, Arrow A is in the direction of the customer opening 20 of the automated banking machine.

As shown in Figure 7 in the mode of operation currently being described, the structures act as a stack assembly mechanism. Once sheet 132 is fully moved through the intersection in the first transport path 146, movement of the sheet in the first direction is stopped. This is

accomplished by the control circuitry 44 operating the transport drives in accordance with its program logic stored in memory, and in response to customer inputs at the customer interface. A sensor schematically indicated 134 positioned in the first sheet path senses the position of the sheet. Sensor 134 is in operative connection with the control circuitry. Sensor 134 may be one of several types of sensors suitable for sensing the position of sheets, such as a photo reflective type sensor. Once sheet 132 is in the position shown in Figure 7, belts 80 and 88 are stopped.

As shown in Figure 8, the control circuitry now operates the components of the machine to move sheet 132 in a second opposed direction as indicated by Arrow B. To move sheet 132 through the intersection in the opposed direction, sheet engaging rolls 112 and belts 116 rotate to prevent sheet 132 from passing into the second sheet transport path 42. Transport section 100 is also operated by the control circuitry to engage sheet 132 and move it in the opposed direction. A sheet turnover member 136 later described in detail, is moved to enable sheet 132 to pass roll 82 in the first sheet path.

As shown in Figure 9 sheet 132 is moved in the second direction until it is engaged between holding rolls 108 and transport section 100. A sensor which is schematically indicated 138 is positioned to sense that sheet 132 is positioned in the holding device provided by the combination of holding rolls 108 and transport section 100. Sensor 138 is operatively connected to the control circuitry which operates to stop further movement of sheet 132 in the second direction when it has reached the position shown. It should be noted that sheet 132 in this position is held adjacent to second intersection 76, which is the intersection of sheet path 74 and sheet path 46.

held by the holding device formed by holding rolls 108 and transport section 100. Thereafter, additional sheets may be added to the stack by passing sheets on transport path 42 and engaging such sheets in aligned relation with the stack in a manner similar to that represented in Figure 10.

It will be appreciated that a stack comprising a significant number of generally aligned and abutting sheets may be formed in the manner described. Because the sheets are selectively dispensed from the dispensing devices and/or sheet producing devices adjacent to transport path 42, the sheets may be stacked in a desired order as determined by the control circuitry. For example, sheets which are currency notes may be stacked in order from highest to lowest denomination, or vice versa. Particular sheets may be placed in a desired location within the stack. Once the stack has been assembled in the desired manner by the control circuitry of the machine, it may be moved in first transport path 46 to the opening 20 so it may be taken by a customer.

It should also be noted that in the position of stack 144 shown in Figure 12, the stack is positioned in the holding device formed by holding rolls 108 and transport section 100 adjacent to intersection 76. Intersection 76 is the intersection of transport path 46 and transport path 74. Transport path 74 extends to the devices housed in the upper enclosure portion 26 of machine 10.

As schematically represented in Figure 16, a sheet 146 may be moved from one of the devices adjacent to sheet path 74 to engage the stack 144 at intersection 76 as the stack moves in the first direction. This enables adding sheets to the stack which are housed in the sheet dispensing devices and/or document producing devices adjacent to sheet path 74. The stack formed by the addition of sheets from sheet path 74 may be moved through sheet path 46 to the customer.

It will be understood that sheets from sheet path 74 may be delivered individually through intersection 76 into sheet path 46, and may thereafter be added to a stack formed at intersection 60 in a manner similar to that previously described. It should also be understood that sheet path 74 includes appropriate sensors that are operatively connected to the control circuitry. The control circuitry operates so that sheets from the sheet path 74 may be added to a stack in engaged, aligned relation with the other sheets in the stack as the sheets pass through intersection 76. As a result the associated structures operate as a further stack assembly mechanism.

As shown in Figure 15, exemplary machine 10 further includes the capability of taking sheets in the first sheet path and turning them over using a turnover device. This may be done as shown in Figure 15, through the use of sheet turnover member 136. Exemplary sheet turnover member 136 comprises a member including arcuate guides or tines conforming to the contour of rolls 82. When the turnover member is positioned adjacent to rolls 82, such as in Figure 15, a moving sheet 148 is caused to be turned over from the position of the sheet in the first sheet path 46. This is accomplished by moving sheet 148 in the direction of Arrow C in Figure 15. In the exemplary embodiment the upper belt flights of belt 80 are part of a sheet path generally indicated 150. Sheet path 150 extends adjacent to printing device 70 and imaging device 72 shown in Figure 3. As a result, the sheet may be selectively moved into sheet path 150 for purposes of conducting printing or marking thereon, such as by a cancellation device, for producing an electronic image of the sheet by an imaging device, or both. Of course other or different functions may be performed.

Once the printing or imaging activity has been conducted on the sheet in sheet path 150, the sheet may be returned to the first sheet path 46. Once the sheet 148 is returned to the first

sheet path it may be selectively moved to one of the other sheet paths 42 or 74. From these sheet paths it may be directed into and stored in an appropriate sheet storage device or location in the machine. Alternatively, sheet 148 may be selectively moved to be combined in a stack with other sheets at intersections 60 or 76. This may in some embodiments provide for the delivery of cancelled checks to a user. Such cancelled checks may be delivered in a stack with other checks, receipts, notes or other documents.

In some embodiments the sheet turnover members 136 may be configured so that sheets in transport path 150 may be directly added to a stack of sheets at the intersection of sheet path 46 and the turnover device. This is accomplished by configuring or moving the turnover member so that the tines in the lower position do not interfere with the passage of a stack of sheets in the first direction past the turnover member. This feature provides yet another stack assembly mechanism and may be particularly advantageous when a customer receipt is printed on a sheet by the printer in sheet path 150, and it is desired to have the receipt at the top of the stack. This may be achieved by positioning the stack in the holding device formed by holding rolls 108 and transport section 100, and moving the stack in the first direction to the right in Figure 15 as the printed receipt sheet is engaged in aligned relation with the top of the stack as the stack moves toward opening 20.

It should be understood that in other embodiments, sheets from paths 74 and 42, as well as from path 150, may all be added to a stack as the stack moves from the holding device provided by transport section 100 and holding rolls 108, in the first direction toward the customer. This can be readily envisioned from the schematic view shown in Figure 16 with the stack 144 moving to the right as shown, and sheets being added to the stack as the stack passes

roll 82 and again as the stack moves through intersection 60. As will be appreciated by those skilled in the art, numerous configurations and operations of the system may be provided depending on the functions carried out by the machine as well as the programming and configuration of the control circuitry.

5 It should be understood that other sheet turnover devices, other than, or in addition to turnover member 136, may be provided in other embodiments. For example, in Figure 18 a directing member 152 is shown in cooperating relation with roll 108. Directing member 152 is selectively movable between the position shown, wherein it is adjacent to roll 108 and the position shown in phantom. As represented in Figure 18, when the directing member 152 is in the position shown it is operative to direct a sheet 154 that is held in the holding device formed by transport section 110 and holding rolls 108 into transport path 74. Sheet 154 may be moved in transport path 74 to a sheet handling device for storage therein in the manner previously discussed.

15 Alternatively, turnover of the sheet 154 may be accomplished by moving it into transport path 174 and thereafter disposing directing member 152 away from roll 108. Once this is done, sheet 154 may again be directed into path 146 and moved to the right as shown in Figure 18 so that sheet 154 will move in a manner comparable to that of sheet 146 shown in Figure 16. This will result in the orientation of sheet 154 being reversed in sheet path 46 from its original orientation.

20 The components adjacent to intersection 60 may also be operated as a sheet turnover device. This is represented schematically in Figure 20. This is accomplished by having a sheet 156 initially positioned in the first sheet path similar to sheet 132 in Figure 7. The sheet is then

moved into the second sheet path at intersection 60 by operating the sheet directing apparatus 110 in a manner that is later discussed in detail. Once sheet 156 is in the second sheet path, the direction of belts 88 and 116 is reversed while the lower flights of belt 80 are moved to move the sheet in the second direction indicated by Arrow B. This results in the sheet being turned over from its original orientation in the transport.

It should be further understood that sheets which originate in transport path 42 may also be directed in the manner shown in Figure 20. This feature enables selectively positioning sheets and turning them over through a number of different mechanisms this enhances the capabilities of the exemplary automated banking machine.

A further useful aspect of the exemplary embodiment is that it includes a separating mechanism for separating sheets from a stack as represented schematically in Figures 13 and 14. The exemplary embodiment shown includes the capability of selectively separating a sheet from a stack of sheets as the stack passes through the intersection 60 of transport path 46 and transport path 42. As schematically represented in Figure 13, a stack of sheets 158 moves in the direction indicated by Arrow B in transport path 46. Although stack 158 is shown as a stack of four sheets, it should be understood that the stack may comprise a greater or lesser number of sheets. Stack 158 may be a stack of sheets received from a user of the machine through opening 20 and may consist of different sheet types. For example in some embodiments stacks accepted in the machine may include stacks of mixed notes, checks and/or other types of sheets

As stack 158 moves toward intersection 60 the control circuitry of the machine operates sheet directing apparatus 110 so that rolls 112 and 114, and belts 116 journaled thereon, move relative to the stack in a direction opposed to the direction of stack movement. As a result of this

movement by the sheet directing apparatus, a first sheet 160 which bounds a first side of the stack, is frictionally engaged by belts 116 and is stripped and separated from the stack. The first sheet 160 is directed into the sheet path 42 as the stack which comprises the remaining sheets continues on path 46. This enables sheet 160 to be handled separately by the devices adjacent to path 42, or to be later brought individually back to path 46 for individual transport to devices adjacent to other paths.

It should be noted that in the exemplary embodiment a sensor 162 is positioned adjacent to path 42. Sensor 162 may be a photo electric sensor connected to the control circuitry for sensing the position of the sheet. Alternatively, sensor 162 may comprise a plurality of similar or different sensors adapted for sensing features of a sheet. Sensor 162 may be part of a validation device such as that previously discussed that is suitable for determining note type and denomination. This enables the control circuitry to properly identify a currency sheet and place it in a designated note handling mechanism, storage position or other the sheet receiving device. Sensors 162 may alternatively operate in connection with the control circuitry to provide a validation mechanism to determine or assess the genuineness of a sheet. In other embodiments other features such as magnetic ink indicia, bar coding and other features may be detected for purposes of identifying the type of sheet as it moves past the sensors.

As previously mentioned, in some embodiments the validation device may be operative to identify particular sheets, such as by serial number or other characteristics. In some embodiments such information may be stored for suspect notes, and in others for all or certain selected categories of notes. Such data concerning individual notes may be stored in a data store in correlated relation with information usable to determine the identity of the user who provided

the note to the machine. Other data may be stored as well, such as for example, the storage location or position where the note is stored in the machine or other information that can be used to recover the particular note and/or to document the transaction.

In some embodiments the machine may hold in a data store, identifying information related to notes for purposes of comparison to notes provided to the machine. This may include in some embodiments information corresponding to properties, characteristics or numbers associated with known counterfeit or invalid notes. Such information used for comparison may also include identifying data for individual notes already deposited in the machine. Thus for example, if a note provided to the machine is individually identified by determining the serial number, the serial number may be compared through operation of the control circuitry to stored data for serial numbers of known counterfeits. Alternatively or in addition, the serial number of the note provided to the ATM may be compared to serial numbers for notes previously deposited or input in the machine. In the event of a match in either example the control circuitry would act in response to the apparent suspect note in accordance with its programming. This may include capturing and storing the suspect note, capturing additional data about the user presenting the suspect note, notifying authorities or taking other action.

In embodiments where identifying data on all notes is captured and used for comparison, the control circuitry may operate to indicate when the note has been dispensed out of the machine. This may include for example deleting the information about the note such as its serial number from the data store upon dispense. Alternatively such indication may include storing the information indicative that the particular note has been dispensed. The information about the note dispensed may in some embodiments be stored in correlated relation with information

unable to identify the user who received the note from the machine. Of course other approaches may be used in other embodiments and the approaches discussed with regard to notes may also be applied to other types of documents.

Returning to the discussion of the operation of the separating mechanism, after sheet 160 is separated from the stack 158 as shown in Figure 14, the control circuitry may operate the transports in the first path 46 to move the remaining stack to a position to the right of the intersection 60. If it is desired to separate an additional sheet from the stack, the remaining sheets may be moved through the intersection again in the direction of Arrow D to accomplish separation of the sheet that is newly bounding the side of the stack. Alternatively, if the control circuitry determines that it is not necessary to separate a further sheet from the stack, the sheet directing apparatus may be operated so that belts 116 and rollers 112 and 114, move in the same direction as rollers 92 and at a similar speed. This will result in the stack passing through the intersection without a sheet being separated from the stack.

It should be understood that while in the embodiment shown the sheet directing apparatus comprises a plurality of rolls having resilient surfaces thereon that move at a relative speed that is less than the speed of the moving stack, in other embodiments other types of stripping and separating devices may be used. These may include for example, resilient pads or rolls. Such devices may also include resilient suction cup type mechanisms or vacuum generating devices. Further alternative forms of sheet directing devices may include other physical members that engage selectively one or more sheets so as to direct them from path 46 into another path 42.

It should also be noted that in the exemplary embodiment shown in Figures 13, 14 and 23, sheets may be separated from a stack as the stack moves from right to left. However, in other

embodiments it may be desirable to arrange the sheet directing apparatus so that sheets may be separated from a stack when the stack moves in either direction. This may be readily accomplished through arrangements of resilient rollers or other stripping devices or members which may be selectively actuated to engage and separate a sheet upon passage of a stack through an intersection. This configuration may have advantages in other embodiments where greater speed in sheet separation is desired.

As will be appreciated from the foregoing discussion, in some banking machines it may be desirable to process certain sheets individually. For example, if it is determined that a sheet separated from a stack is a check or other negotiable instrument that must be transferred to the imaging device, it may be desirable to clear a path which enables the sheet requiring such handling to be transported individually. This can be accomplished by disposing the stack of sheets that are not currently being processed individually away from the single sheet in first path 46. In this manner the sheet requiring individual handling can be transferred to path 150 or such other location as may be necessary without causing the remaining stack to undergo transport to an undesirable location.

A further alternative to facilitate individual handling of particular sheets is represented by the alternative embodiment shown in Figure 19. In this embodiment path 46 includes three separately controlled transport sections 164, 166 and 168. Transport section 164 is similar to the transport previously discussed, except that its belts terminate at rolls 170 and 172. Transport section 166 may include an interwoven belt transport similar to that shown in Figure 5 with the exception that its belts are offset from those in transport section 164. Transport section 166 may be driven by one or more independent reversible drives from transport section 164. The drive for

transport section 166 is in operative connection with and operates under the control of the control circuitry.

Transport section 166 terminates in rolls 174 and 176. Rolls 174 and 176 are coaxial with other rolls that are spaced intermediate thereto that are part of transport section 168.

5 Transport section 168 terminates at rolls 178 and 180 which are adjacent to a customer accessible opening indicated 182. Transport section 168 is operated by at least one independent reversible drive in response to the control circuitry.

Transport sections 166 and 168 along path 46 provide locations in which documents or stacks of documents may be temporarily stored as other documents are routed through intersections 60 and 76. After the necessary processing is done on the individual documents, the documents that are temporarily stored in the transport sections 166 and 168 may be moved to other transport sections for further processing. It should be understood that transport sections 166 and 168 include appropriate sensors for sensing the positions of the documents being temporarily stored therein which enables the control circuitry to coordinate movement thereof.

15 A further advantage of the exemplary embodiment described herein is that not only may the automated banking machine 10 accept individual documents and stacks of documents from a customer, but it may also accept conventional deposit envelopes. As shown in Figure 17 a thick sheet like deposit envelope 184 may be moved along path 46 from a customer. The identification of the deposited item as a deposit envelope may be made based on readings from sensors 126,
20 128 or 130 as shown in Figure 4, or alternatively or in addition based on customer inputs through one or more input devices at the customer interface 12 of the machine.

Deposit envelope 184 moves in transport path 46 in the direction of Arrow E as shown in Figure 17. Upon determining that the item moving in the transport path is a deposit envelope, the control circuitry operates the sheet directing apparatus 110 to direct the envelope into transport path 42. The control circuitry also enables roll 96 and belts 88 to move in the direction indicated by Arrow F. This causes the flight of belt 88 to move to the position shown in phantom in Figure 4. This enables the envelope to move into the depository device 40 (see Figure 3) in which it may be stacked in aligned relation with other envelopes. Further the control circuitry may also operate transport 118 and rolls 124 shown in Figure 4 to assure that envelope 184 does not pass further along sheet transport path 42 than the depository 40.

The ability of the embodiment of the automated banking machine to handle depository envelopes, stacks of sheets and individual sheets, provides enhanced functionality for the machine. The ability of the exemplary embodiment to accept thick items in the area of path 42 adjacent to the intersection, also enables the control circuitry to use the area adjacent to the intersection as a temporary storage location for stacks of sheets. This may be desirable in some embodiments where a receipt form is delivered on transport path 74 and must be directed to transport path 150 for printing thereon before being combined with a stack to be delivered to a customer.

The exemplary embodiment of the ATM has the capability of storing the assembled stack of sheets adjacent to intersection 60 in transport path 42 until such time as the printed receipt is moved into the intersection along first path 46. As the receipt form is produced by a document producing device and moved into the intersection 60 by transport section 100, the stack is moved into the intersection in coordinated relation therewith so that the printed receipt is assembled into

the stack and positioned at the top side of the stack. The assembled stack may be moved along transport path 46 to the opening where it may be taken by the customer.

In some embodiments the ATM may also operate to provide certain types of documents in exchange for other documents. As previously discussed, some embodiments may receive
5 checks or other instruments, validate the check, and provide the user with currency notes. In some embodiments, a user may provide notes to the ATM and receive other types of documents such as money orders, scrip, vouchers, gift certificates or bank checks. In some embodiments the control circuitry may operate in the manner previously discussed to store information concerning individual notes in a data store in correlated relation with information usable to identify the user who deposited the notes in the machine. Some embodiments may store in correlated relation
10 with all or a portion of such data, information which identifies the check, money order or other document provided by the machine to the user.

In some embodiments the ability of a single user to provide cash to the ATM may be controlled or limited to avoid money laundering or other suspect activities. For example, a user
15 placing notes in the ATM to purchase money orders or other documents, may be required to provide at least one identifying input. This may include a biometric input such as a thumbprint for example. Such at least one identifying input may include data on a card or other device a user provides to operate the machine, or may be in lieu thereof or in addition thereto. Alternatively, some embodiments may enable use of the ATM to buy documents such as money orders, gift
20 certificates or other documents without using a card or similar device to access the machine. In some cases a user may exchange notes of certain denominations for notes of other

denominations. In such cases the control circuitry may require at least one identifying input from the user requesting to exchange cash for other documents.

The control circuitry may operate in accordance with programmed instructions and parameters to limit the number or value of documents a user may purchase or otherwise receive.

5 This may include comparing user identifying data with data input in connection with prior transactions. This may be done by comparing user input data stored in a data store at the particular ATM, and/or data stored in computers connected to the ATM. By limiting the number or value of documents a user can purchase with cash, either overall, for a particular document or within a given time period, the risk of illegal activities such as money laundering can be minimized. Further such systems may more readily enable funds to be tracked.

An alternative embodiment of an automated banking machine is indicated 186 in Figure 22. Machine 186 is similar to machine 10 except that it includes two fascias and customer interfaces designated 188 and 190. Machine 186 is capable of operation by two users generally simultaneously.

15 The sheet handling mechanism for machine 186 is indicated 192 in Figure 21. The sheet handling mechanism 192 is similar to that described in the first embodiment, except as otherwise noted. Mechanism 192 includes a first customer accessible opening 194 in customer interface 190, and a second customer accessible opening 196 in customer interface 188. Customer opening 196 receives and delivers sheets through a transport section 197. Transport section 197
20 is preferably an interwoven belt type transport of the type shown in Figure 5 and is capable of moving sheets, envelopes and stacks of sheets in engagement therewith. Transport section 197 is

operated by a reversible drive similar to the reversible drives used for the other belt transport sections, and is in operative connection with the control circuitry of the machine.

The operation of the alternative sheet handling mechanism 192 is similar to that previously described except that the sheets, envelopes or stacks of sheets that are processed may be received from or delivered to either customer opening 194 or customer opening 196. Because of the high speed capability of the exemplary embodiment, it is possible for the sheet handling mechanism 192 to adequately service two users simultaneously without undue delay.

As will be appreciated from the foregoing description, the modifications necessary for the sheet handling mechanism of the first embodiment to accommodate two simultaneous users is relatively modest. In the exemplary embodiment it is possible to increase the number of customer interfaces on the machine from one to two at a relatively small cost. This is particularly advantageous for an automated teller machine positioned in a high customer traffic area. It is also useful for automated banking machines, such as those used by tellers to count and dispense currency notes. This is because the configuration of the sheet handling mechanism enables two tellers or other personnel to be serviced by a single machine.

Exemplary embodiments may operate to assure operation in accordance with the principles of U.S. Application Serial No. 09/664,698 filed September 19, 2000, the disclosure of which is incorporated by reference as if fully rewritten herein.

Thus the automated banking machine of the exemplary embodiment of the present invention achieves at least some of the above stated objectives, eliminates difficulties encountered in the use of prior devices and systems, solves problems and attains the desirable results described herein.

In the foregoing description certain terms have been used for brevity, clarity and understanding. However, no unnecessary limitations are to be implied therefrom because such terms are used for descriptive purposes and are intended to be broadly construed. Moreover the descriptions and illustrations given are by way of examples and the invention is not limited to the exact details shown or described.

In the following claims any feature described as a means for performing a function shall be construed as encompassing any means capable of performing the recited function, and not mere equivalents of the particular means described in the foregoing description. The inclusion of an Abstract shall not be deemed to limit the claimed invention to the features described in such Abstract.

Having described the features, discoveries and principles of the invention, the manner in which it is constructed and operated, and the advantages and useful results attained; the new and useful structures, devices, elements, arrangements, parts, combinations, systems, equipment, operations, methods and relationships are set forth in the appended claims.